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BY

J. LEONARD CORNING, M. D.,

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ELECTRIZATION OF THE SYMPATHETIC AND PNEUMOGASTRIC NERVES,

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One of the most favorable localities for *directly* influencing the functions of the brain is situated in the neck. Owing to the contiguity of important anatomical features in the cervical region, we are enabled, by appropriate means, to lay hold simultaneously upon three great physiological principles, and to appropriate the same to the ends of rational therapy.

At a point situated between the angle of the lower jaw and the hyoid bone, on the one hand, and between the internal border of the sterno-cleido-mastoid muscle and the continuation of the tracheal line, on the other, are situated: 1. The internal carotid; 2, the pneumogastric nerve; 3, the sympathetic nerve. Besides these important structures, we have the jugular veins, adjacent subsidiary nerve-stems, etc.

First Proposition.—The ramifications of the internal carotids afford the principal blood-supply of the cortical areas. If that blood-supply be artificially varied, by compression applied to the arterial stem, a commensurate modi-

fication of the functions of the higher centers ensues. The extensity and intensity of cortical function are, to be brief, in a certain sense dependent upon the degree of sanguineous irrigation.

The evidence in favor of this proposition is overwhelming, and has been cited by me so often during the past three years that I shall abstain from further repetition of what must now be accepted as an axiom of physiology.

Second Proposition.—The pneumogastric, so far as its effect upon the heart is concerned, belongs in the category of the so-called "regulating" nerves.

When the pneumogastric is excited either by mechanical means (pressure), chemically, or electrically, the frequency of the heart's action is diminished. Where the excitation is very severe, it is possible to cause cessation of the latter (Ed. Weber).

After the commencement of the excitation, a short time elapses before the retarding influence upon the cardiac action begins ("Latent Stage" of Donders and Prahl).

Third Proposition.—The sympathetic nerve has a direct modifying influence upon the circulation, metamorphosis (nutrition), and calorification of the organs and histological elements to which it is distributed.

When the cervical sympathetic is excited by the galvanic current, for example, the following phenomena are observed: 1. Dilatation of the pupil and protrusion of the eyeball; 2. Contraction of the vessels and diminution of temperature in the corresponding half of the face and brain (*Vide* the experiments of Nothnagel, Claude Bernard, Brown-Séquard, and others).

Granting that the preceding propositions embody sound physiology, it is evident that, if we could diminish the caliber of the two arteries which supply by far the greater amount of blood to the brain, and at one and the same time excite

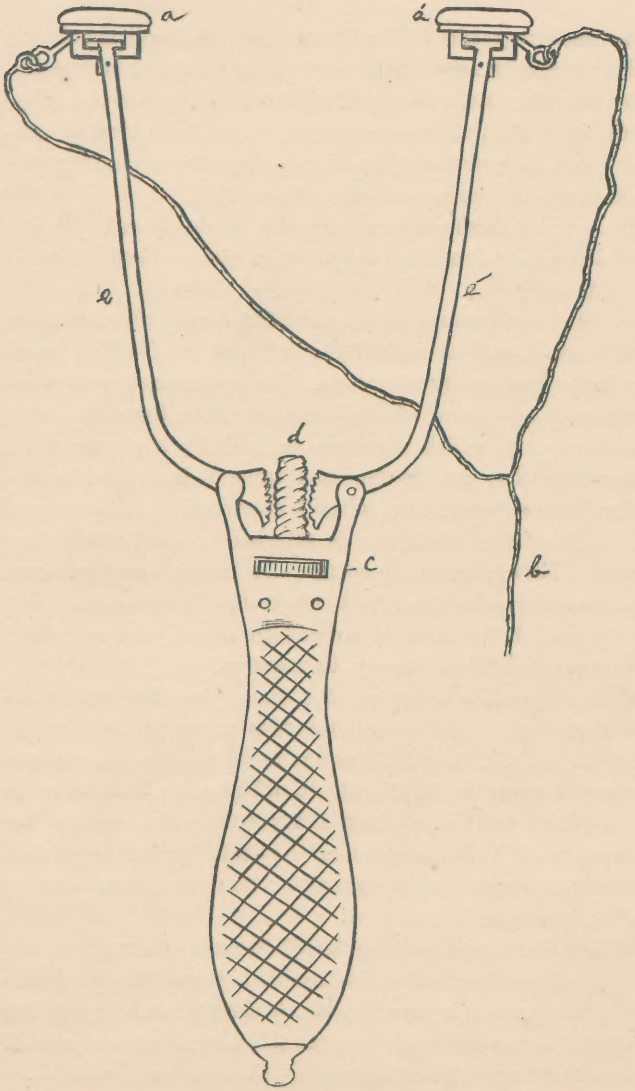

FIG. 1.—*a a'*, insulated sponge electrodes in connection with the bifurcated conducting wire *b*; *c*, milled wheel, the rotation of which causes the screw *d* to act upon the armatures *e e'*, thus enabling the operator to expand or approximate the latter at will.

the pneumogastric and sympathetic nerves, we should be able to exert a very complete physiological control over the metamorphosis of the organ. With the object of obtaining this threefold end, I have devised certain electrical attachments to an instrument, previously designed by me for simple, temporary compression of the carotids.

As this instrument may be unknown to some, I will give a brief description of its construction and method of application.

The chief features of this appliance are two curved metallic armatures, to each of the extremities of which is attached a small sponge electrode. These sponge electrodes are insulated by means of hard rubber plates from the metal armatures, to which they are secured by a simple slide. Moreover, they can be detached when it is desired to employ simple compression, without electrization of the nerves. To each of the electrodes is attached a small conducting cord. These conducting cords unite in one common stem, so that the polarity of both electrodes is the same. The other end of the stem is secured to one of the poles of a galvanic or faradaic battery, as required.

It is possible by means of a screw, provided with a detachable key, to place the electrodes at any desired angle. The object of this device is to enable the operator to exercise pressure upon the carotids in an oblique direction, so as to press the latter away from the jugular vein, and in the direction of the spinal column. By this means it is possible to reduce venous compression to a minimum, except where undue pressure is employed.

The disengaged extremities of the curved armatures are attached to a handle. This handle is pierced by an Archimedean screw so arranged that, by simply rotating a milled wheel, the armatures can be extended or approximated at will. An exceedingly fine adjustment is thus rendered possible.

The method of employing the instrument just described is exceedingly simple. The patient, if in bed, is placed in a

FIG. 2.—A, differential calorimeter, connected with the thermo-electric piles *d d'* by means of the conducting wires *e e'*. B, galvanic battery connected with the electro-compressor C by means of the bifurcated conducting wire *f*. The electrode at the extremity of the other conducting wire *f'* is placed on the neck.

horizontal and semi-dorsal position, with the head supported by a cushion beneath the neck, in such a manner as to allow the former to fall slightly backward, while the cervical vertebræ are protruded anteriorly. The operator then takes his place by the bedside, his left side being turned toward the patient. Then, having with the index-finger and thumb ascertained by careful exploration the exact position of the carotids, he proceeds, after accurately adjusting the armatures, to apply the instrument in such wise that the electrodes

will press the arteries away from the pneumogastric nerve and jugular vein in the direction of the spinal column. In applying the instrument, it should be held in the right hand, the handle of the same forming a perpendicular to the arteries. By pressing the left hand firmly against the posterior portion of the neck, the operator is enabled to execute any counter-pressure which may be required, and at the same time to contribute to the support of the head in the desired position. Compression should, however, never be carried so far as to cause entire closure of the lumina of both arteries; such a procedure may cause convulsions, as the anastomotic facilities at the circle of Willis are usually unequal to these unwonted circulatory exigencies. This contingency is, however, not liable to arise, as the degree of pulsation in the temporal arteries affords reliable information as to the extent of the circulatory obstruction.

When the instrument has been properly adjusted, an assistant applies the disengaged electrode (usually the positive) over the posterior aspect of the cervical vertebræ.

All being in readiness, the strength of the battery is gradually increased.

It is impossible to determine in advance how many cells may be required, as this will depend greatly upon the strength of the battery, the thickness of the cervical adipose tissue, and the degree of compression employed. The greater the amount of compression the less the strength of the current should be, and *vice versa*.

Care should be exercised to avoid dizziness or syncope, and the strength of the current and degree of pressure should at all times be regulated with the utmost nicety. Sudden variations in either of these factors are to be carefully avoided.

By reference to the physiological proposition at the

beginning of this article it will be seen that we accomplish simultaneously a threefold end by this method of treatment, namely: (1) Diminution of the amount and pressure of the cortical blood-stream; (2) contraction of the cerebral capillaries; and (3) retardation of the heart's action (*when currents of considerable strength are employed*).

Besides these results, it is extremely probable, judging from experimental researches, that a *direct* limitation of the processes of intra-cellular activity is also attained.

Theoretically, a more perfect method of limiting cerebral metamorphosis can hardly be imagined. The advantages of this mode of treatment are, moreover, demonstrated in practice, particularly where we have to deal with insufficiency of the vaso-motor mechanism.

Thus, in congestive headache (angio-paralytic form of migraine) its effects are positively magical. Such cases may frequently be cured in the space of a few moments by resort to this mode of treatment. I know of no remedy at all comparable with this.

I have great hopes also that this means of treatment may prove of value in epilepsy, although my experience with it in this connection is still too limited to express a positive opinion as to its ultimate value as a therapeutic measure in this disease.

On *a priori* grounds, I am inclined to anticipate good results from its employment in the first stages of general paralysis of the insane. I am at present about to engage in some researches as to its applicability in this connection.

As to the current to be employed, my experience thus far leads me to give the preference to the galvanic. Sometimes the interrupted galvanic current may be employed, but under such circumstances the current should not be too strong.

Besides the more obvious physiological effects already

referred to, I have noticed the following phenomena in connection with the procedure just described: 1. Dilatation of the pupil. 2. Drowsiness. 3. Dizziness (where too great pressure or excessively strong currents are employed). 4. Drooping of the eyelids. 5. Retardation of the heart's action (where strong currents are used). 6. Pallor about the lips and upper portion of the face. 7. Muscular weakness, as proved by the dynamometer; the subject, if standing, complains of weakness in the knees. 8. If the compression and strength of the current be great, syncope may be produced. 9. Diminution of the temperature over the parietal bones. Lombard's thermo-electric differential calorimeter shows a very considerable difference between the peripheral temperature and that of the head. 10. Very interesting is the observation that the primary stage of excitement incident to etherization is cut short by resort to this method, and the amount of the anæsthetic required proportionately reduced.

The location of the point in the neck which I have thus far adopted as being the best suited to this method of treatment is described at the beginning of this article.

The sudden cardiac depression, so much feared by some of the opponents of galvanization of the sympathetic, is easily avoided by proper caution as to the strength of the current.

One of the great advantages of this method of treatment consists in the possibility which it affords of employing comparatively weak currents, as well as very moderate arterial pressure.

From my own observations, I can not help believing that this method of treatment represents a substantial advance in electro-therapeutics.

Galvanization of the sympathetic is far more effectual when thus employed than when used without simultaneous

compression of the arterial stems. The reason for this is plain. Owing to the reduced arterial tension in the smaller vessels, consequent upon compression of the main trunks (carotids), it is far easier for the muscular coats of the former to contract, as the resistance to be overcome is considerably diminished.

It is hardly necessary to draw attention to the solid physiological basis upon which this method of treatment is based.

When, however, as in this instance, both physiology and empiricism coincide, we have a strong case.

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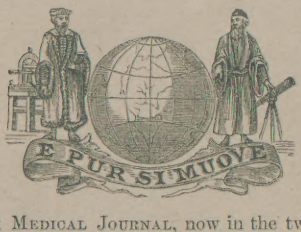

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M. D.

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